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Dothistroma Needle Blight of Pines

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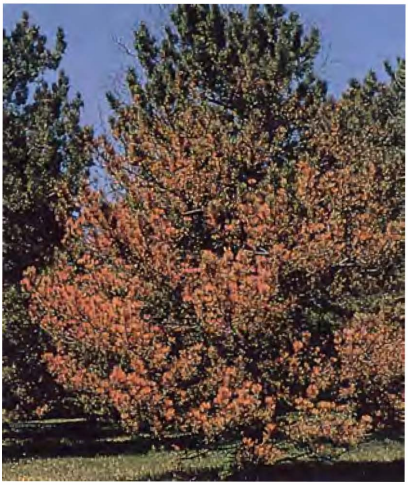
Dothistroma blight is a devastating foliar disease of a wide range of pine species. The causal fungus, *Dothistroma pini* Hulbary, infects and kills needles. Premature defoliation caused by this fungus has resulted in complete failure of most ponderosa pine plantings in States east of the Great Plains. In the central and southern Great Plains, *D. pini* damages Austrian and ponderosa pines in Christmas tree, shelterbelt, and landscape plantings. In California, Oregon, and Washington, the fungus damages plantings of lodgepole and Monterey pines. Infection by *D. pini* occurs sporadically in natural stands of lodgepole and ponderosa pines in Idaho, Montana, and Washington.

The fungus has seldom been detected in young seedlings in nurseries in the United States. Yet, experience with epidemics in isolated new plantings in the central Great Plains indicates that trees infected in the nursery must have been responsible. The fungus is common on older transplants in nurseries that produce pines for landscape plantings. These nurseries are located in the Central States.



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Dothistroma pini occurs in States shown in figure 1 and in southwestern Alaska. Twenty pine species and hybrids are known hosts in the United States. In the Central and Eastern United States, the fungus is found most often in plantings of Austrian and ponderosa pines. These two species are highly susceptible. The fungus has not been reported in natural pine stands in the Eastern and Central United States.

Description

Early symptoms consist of deep-green bands (fig. 2) and yellow

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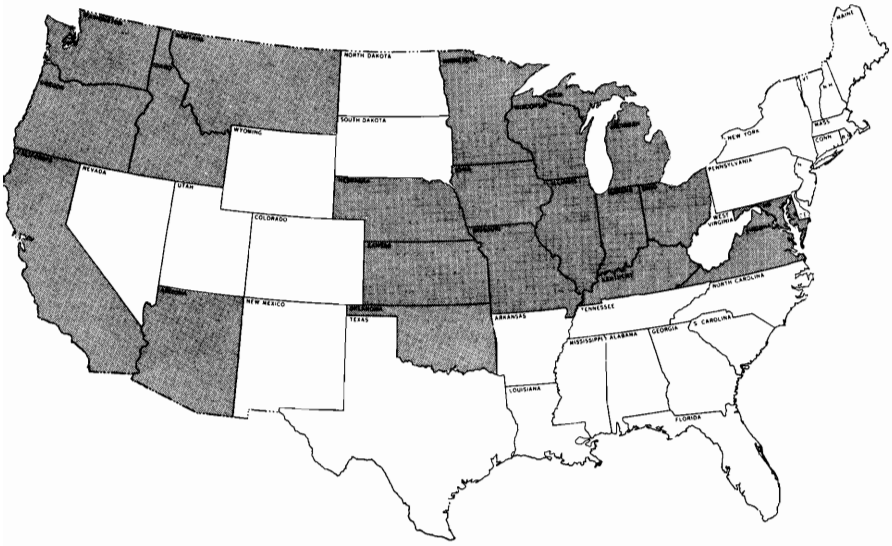

Figure 2.—*Early symptoms (deep green bands) on Austrian pine needles infected with* Dothistroma pini. F-702941

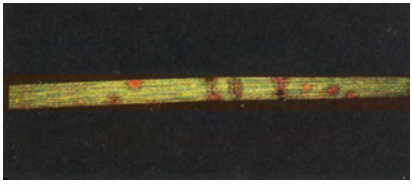

Figure 3.—*Spots and bands on Austrian pine needles infected with* Dothistroma pini. F-702942

and tan spots on needles. The deep green color of bands does not last and cannot be detected unless observed at the onset of symptom development. Later, the spots and bands turn brown to reddish brown (fig. 3). The bands are brighter red and more numerous on pines in California, Oregon, Washington, and Idaho, where this disease is often referred to as the "red band" disease.

The ends of infected needles progressively turn light green, tan, and brown, with the base of the needles remaining green (fig. 4).

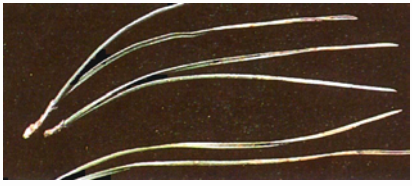

Figure 4.—*Typical appearance of infected Austrian pine needles: needle tips brown, needle bases green.* F-702943

Needles may develop extensive necrosis (browning) 2 to 3 weeks after the first appearance of symptoms. Infection is typically most severe in the lower crown (fig. 5).

Figure 5.—Dothistroma pini *damage severe in lower crown.* F-702944

Infected needles drop prematurely. Infected second-year needles are cast before infected current-year (first-year) needles. In some seasons, second-year needles are cast in the late fall of the year they became infected. In other seasons, loss of second-year needles is not extensive until late the following spring or early summer. Needles that become infected the year they emerge often are not shed until late summer the following year.

Successive years of severe infection result in decreased growth and, ultimately, death. The disease makes pines in landscapes unsightly and pines in Christmas tree plantings unmarketable.

Dothistroma needle blight can be mistaken for brown spot disease caused by the fungus *Scirrhia acicola.* The symptoms on needles are similar. With both diseases, trees are affected first in the lower crown. The dark stromatic fruiting bodies of *D. pini* and *S. acicola* look alike after they have erupted and split the epidermis. When a common host is involved, these two fungi can be distinguished only by microscopic examination of conidia. The conidia are somewhat similar in shape and size, and both have cross-walls. However, conidia of *D. pini* are hyaline whereas conidia of the brown spot fungus are colored, usually a greenish brown.

These two fungi have several hosts in common. However, Scots pine, which is severely damaged by the brown spot fungus, is rarely infected and seldom damaged seriously by *D. pini.* A plantation of 36 geographic sources of Scots pine in eastern Nebraska has remained free of Dothistroma blight, but an adjacent plantation of Austrian pine has been severely damaged.

Life Cycle

The fungus has both a sexual stage *(Scirrhia pini)* and an asexual stage *(Dothistroma pini).* In the United States, the sexual stage has been found only in Alaska, California, and Oregon. The stromata of the sexual stage produce ascospores, whose role in the development of epidemics is not known. Much is known about the role of conidia (spores produced by the asexual stage) in disease development (fig. 6). Conidia from Western States are considerably longer on the average than those found elsewhere in the United States. These differences in length of conidia have led to a designation of three varieties of the fungus: *linearis,* the longest spored form, is found in Western States; *pini,* the shortest spored form is found in Central and Eastern States; and

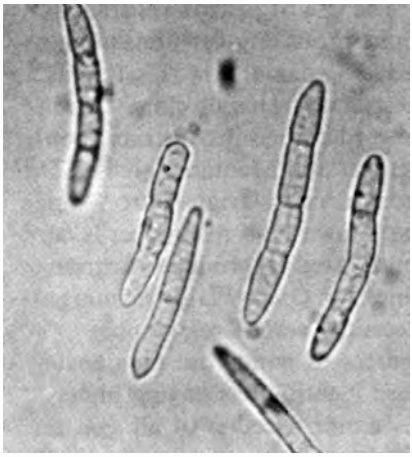

Figure 6.—*Conidia of* Dothistroma pini. F-531036

keniensis, with conidia intermediate, is found in East Africa.

Conidia are borne in stromata (fruiting bodies), which develop below the epidermis of needles (fig. 7). In the Central United States, stromata may develop sufficiently in the fall to raise and split the epidermis. They generally do not mature and produce conidia until the following spring. The epidermis is split longitudinally along two sides of the dark stromatic bodies, with a fragment of the epidermis often adhering to the top of the fruiting bodies. The conidia are exposed as the epidermis is raised. They are released during wet weather and dispersed by rainsplash any time during the growing season. Thus, new infections can occur any time it rains from May to October. However, symptoms do not appear on newly infected needles until early fall in the Central United States.

Two growing seasons are required for completion of the life cycle in most areas of the United States; although in California and Oregon, the cycle may be completed in 1 year. In these States, the period between infection and appearance of symptoms is much shorter than in other States.

Figure 7.—*Fruiting bodies of* Dothistroma pini *raising the epidermis of needles.* F-702945

Control

Copper fungicides effectively prevent infection by *D. pini.* Bordeaux mixture applied twice in the growing season has provided good protection of pines in shelterbelt, Christmas tree, park, landscape, and other plantings in the Central United States. Chlorothalonil is also registered for use against *D. pini.* Fungicides containing copper salts of fatty and rosin acids, however, are registered for control of Dothistroma blight only in the North Central States.

The first application (mid-May) protects needles from previous seasons; the second application protects current-year needles. When control is intended for plantings of Austrian or ponderosa pines, the second application can be made after considerable new growth has occurred because current-year needles of these species initially resist infection and do not become susceptible until midsummer (July).

Effective control has also been obtained in plantings in the Cen-

tral United States with a single application made after considerable growth has occurred (early June). There is some risk in this procedure, since infection could occur in previous years' needles before the early June application. A single application will control this disease on trees that do not have susceptible current-year needles. Many Christmas tree growers in the Central United States are effectively controlling Dothistroma with a single fungicide application.

Annual spraying for control of Dothistroma blight is unnecessary in certain types of plantings. Because control of this disease can be obtained with fungicides, managers can risk not spraying in park, residential, and similar types of plantings. If infection occurs during a year in which fungicide has not been applied, fungicide can be applied the next year with confidence that good control will be obtained. If little or no infection occurs the year fungicide was not applied, spraying can be skipped for another year. On the other hand, Christmas tree growers should probably not skip spraying any years because of the high possibility of great financial loss.

Procedures for control of the disease in the Western United States will differ from those that are effective in the Central United States because of differences in the life cycle of the fungus, hosts, growth, and weather. Experience with this disease in Christmas tree plantings of shore pine in Oregon indicates that fungicide should be applied earlier than in the Central United States.

The use of genetic resistance looks promising for preventing or reducing damage by this fungus. Resistant strains or clones have been identified in Austrian, ponderosa, and Monterey pines. Seed from a Yugoslavian source, which has shown high resistance, is currently used to produce Austrian pines for Great Plains plantings. Recently, several geographic sources of ponderosa pine have been identified as having high resistance. Needles of all ages are highly resistant on some trees. On other trees, current-year needles are resistant, but older needles are susceptible (fig. 8).

Figure 8.—*Resistant first-year needles and susceptible second-year needles of Austrian pine.* F-702946

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Pesticides used improperly can be injurious to human beings, animals, and plants. Follow the directions and heed all precautions on labels. Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides where there is danger of drift when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment, if specified on the label.

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